

EHR Usability Test Report of Crystal Practice Management Version 5.0

Report based on NISTIR 7742 Customized Common Industry Format Template for Electronic Health Record Usability Testing

Crystal Practice Management Version 5.0

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Executive Summary

In September of 2017, a usability study of Crystal Practice Management from Abeo Solutions, Inc., an ambulatory electronic health record software for optometric offices, was conducted remotely by Crystal Practice Management. The purpose of this summative study was to test and validate the usability of the current user interface and provide evidence of usability in the HER Under Test (EHRUT).

During the usability test, 10 current users of Crystal Practice Management served as participants in the usability test. Each participant used the EHRUT in simulated, but representative tasks.

This study collected performance data on 10 tasks covering the 12 specified certification criteria of the 170.31(g)(3) Safety-Enhanced Design. The certification criteria covered are:

- §170.315(a)(1) Computerized Provider Order Entry – Medications
- §170.315(a)(2) Computerized Provider Order Entry – Laboratory
- §170.315(a)(3) Computerized Provider Order Entry – Diagnostic Imaging
- §170.315(a)(4) Drug-Drug, Drug-Allergy Interactions Checks
- §170.315(a)(5) Demographics
- §170.315(a)(6) Problem List
- §170.315(a)(7) Medication List
- §170.315(a)(8) Medication Allergy List
- §170.315(a)(9) Clinical Decision Support
- §170.315(a)(14) Implantable Device List
- §170.315(b)(2) Clinical Information Reconciliation and Incorporation
- §170.315(b)(3) Electronic Prescribing

During the 45-minute one-on-one usability test, the administrator greeted the participant and reviewed the previously signed informed consent/release form (see Appendix 3).

All participants were current users of Crystal Practice Management, so they had prior experience with some version of the EHR.

The administrator introduced the test and instructed participants to complete a series of tasks (given one at a time) using the EHR Under Test (EHRUT).

During each test, the participant's screens were recorded electronically and the administrator recorded notes on paper. The recordings were later analyzed to determine task times and evaluate user performance.

The UCD process used was based on NISTIR 7741¹ and various recommended metrics were used to evaluate the usability of the EHRUT. Use was in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*. The following quantitative data were collected for each participant:

- Task success (%)
- Task failure (%)
- Task standard deviations (%)
- Task performance time
- User satisfaction rating (based on a scale with 1 as very difficult and 5 as very easy)

The results from the System Usability Scale² scored the subjective satisfaction with the system based on performance with these tasks to be: 71.75.

In addition, results include the following qualitative observations:

- Major findings
- Areas for improvement
- Participant's verbalizations

¹ National Institute of Standards and Technology. (November 2010). *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records* (NISTIR 7741). Gaithersburg, MD. nist.gov/publications/nistir-7741-nist-guide-processes-approach-improving-usability-electronic-health-records.

² See Tullis, T. & Albert, W. (2008). *Measuring the User Experience*. Burlington, MA: Morgan Kaufman (p. 149). Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

Introduction

The EHR Under Test (EHRUT) tested for this study was Crystal Practice Management 5.0, an ambulatory electronic health record software. Designed to present medical information to healthcare providers in an optometric outpatient setting, Crystal Practice Management consists of a comprehensive electronic clinical system used to create, store, and retrieve patient data. Intended users of Crystal Practice Management are optometrists, ophthalmologists, and anyone entering or accessing clinical data at an ambulatory optometric practice. The usability testing attempted to represent realistic exercises and conditions in a typical optometric office.

The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT). To this end, measures of effectiveness, efficiency, and user satisfaction, such as task success, time to complete task, task errors, path deviation, participant verbalizations, and participant's satisfaction rating of the system were captured during the usability testing.

Method

Participants

A total of 10 participants were tested on Crystal Practice Management. Crystal Practice Management coordinated the recruiting of participants with the owners of several optometric practices. For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants; an example of a screener is provided in Appendix 1.

In addition, participants had no direct connection to the development of Crystal Practice Management or Abo Solutions, Inc. Participants were given the opportunity to have the same orientation and level of training as the actual end users would have received.

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. The following is a table of participants by characteristics, including demographics, professional experience, computing experience and user needs for assistive technology. Participants names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

Total Number and Description of Participants

The total number of participants was 10. Their descriptions are indicated in the table below:

Participant Summary								
Participant Identifier	Participant Gender	Participant Age	Participant Education	Participant Occupation/Role	Participant Professional Experience	Participant Computer Experience	Participant Product Experience	Participant Assistive Technology Needs
ID01	Female	40-49	Some college credit, no degree	Insurance/Billing	180	300	192	No
ID02	Female	50-59	Some college credit, no degree	Insurance Billing and coding	348	348	168	No
ID03	Female	60-69	Associate degree	Contact Lens Optician	480	360	156	No
ID04	Female	40-49	Some college credit, no degree	Optometric Assistant	54	300	9	No
ID05	Female	50-59	High school graduate, diploma or the equivalent (for example: GED)	Optometric Assistant	156	348	12	No
ID06	Female	30-39	Bachelor's Degree	Optician	180	240	36	No
ID07	Male	20-29	Some college credit, no degree	Optician	48	228	4	No
ID08	Female	50-59	No high school degree	Optometric Assistant	384	300	168	No
ID09	Female	20-29	Some college credit, no degree	Insurance/Billing	72	264	48	No
ID10	Female	20-29	High school graduate, diploma or the equivalent (for example: GED)	Insurance/Billing	42	228	42	No

Ten participants matching the demographics in the Participants section were recruited and all ten participated in the usability test. (See Appendix 2.)

Participants were scheduled for 45-minute sessions. A minimum time interval of 15 minutes was scheduled between sessions for debrief by the administrator, and to reset systems to proper test conditions. An electronic schedule was used to keep track of the participant schedule and included key identification details for each participant.

Study Design

Overall, the objective of this test was to uncover areas where the application performed well—that is, effectively, efficiently, and with satisfaction—and areas where the application failed to meet the needs of the participants. The data from this test may serve as a baseline for future tests with an updated version of Crystal Practice Management. In short, this testing serves as both a means to record or benchmark current usability and to identify areas where improvements must be made.

During the usability test, participants interacted with 1 EHR. Each participant used the same system located on a remote desktop. Each participant was provided with the same instructions. The system was evaluated for effectiveness, efficiency and satisfaction as defined by measures collected and analyzed for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participant’s verbalizations (comments)
- Participant’s satisfaction ratings of the system

Additional information about the various measures can be found in the Usability Metrics section of this report.

Tasks

Ten tasks were constructed that would be realistic and representative of the kinds of activities a user might perform with this EHR. Tasks were selected based on the twelve ONC CEHRT2015 certification criteria, considering frequency of use, potential for risk to patient safety, and criticality of function. The tasks have been prioritized with regards to risks associated with user errors. The Safety-Enhanced Design tasks for the twelve ONC CEHRT2015 certification criteria including:

Task 1: Demographics 170.315(a)(5)/Clinical Decision Support 170.315(a)(9)

- Observe Clinical Decision Support for Hispanic or Latino (Checklist ID: a.9.8)
- Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity (Checklist ID: a.5.1)
- Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity (Checklist ID: a.5.1)
- Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity (Checklist ID: a.5.1)
- Enter dual granular race (Checklist ID: a.5.1)
- Enter dual granular ethnicity (Checklist ID: a.5.1)
- Decline to specify Demographics (Checklist ID: a.5.1)

Task 2: CPOE Medications 170.315(a)(1)/E-Prescribe 170.315(b)(3)

- Prescribe Medication
 - 2.1 Create the order/Record Medication via CPOE (Checklist ID: a.1, b.3.1)
 - 2.5 Check the status/Receive fill status notification (Checklist ID: b.3.1)

- 2.2 Change Medication Order
 - 2.3 Cancel the order (Checklist ID: a.1, b.3.1)
 - 2.4 Refill the order/Change Medication via CPOE (Checklist ID: b.3.1)
 - 2.5 Check the status/Display changed CPOE medication order/Receive fill status notification (Checklist ID: a.1, b.3.1)

Task 3: Drug-drug, Drug-allergy Interaction Checks 170.315(a)(4)/E-Prescribe 170.315(b)(3)

- Add medication and report allergy warning (Checklist ID: a.4, b.3.2)
 - Allscripts automatically requests and receives the medication history, both active and discontinued
- Add medication and report drug warning (Checklist ID: a.4, b.3.2)
 - Allscripts automatically requests and receives the medication history, both active and discontinued
- Adjust severity level of drug-drug interaction (Checklist ID: a.4)
- Verify only administrator privileges can change severity level (Checklist ID a.4)

Task 4: Medication List 170.315(a)(7)/ Clinical Decision Support 170.315(a)(9)

- Review active and historical medication list (Checklist ID a.7)
- Add to medication list (Checklist ID a.7)
- Observe clinical decision prompt (Checklist ID a.9.3)

Task 5: Medication Allergy List 170.315(a)(8)/ Clinical Decision Support 170.315(a)(9)

- Review active and historical allergies (Checklist ID a.8)
- Add allergy (Checklist ID a.8)
- Observe clinical decision prompt (Checklist ID a.9.4)

Task 6: CPOE Laboratory 170.315(a)(2)

- Create a lab order (Checklist ID a.2)
- Change the lab order (Checklist ID a.2)

Task 7: CPOE Radiology 170.315(a)(3)

- Create radiology order (Checklist ID a.3)
- Change radiology order (Checklist ID a.3)

Task 8: Problem List 170.315(a)(6)/ Clinical Decision Support 170.315(a)(9)

- Review active and historical problem list (Checklist ID a.6)
- Change active and historical problem list (Checklist ID a.6)
- Observe clinical decision prompt (Checklist ID a.9.5)

Task 9: Clinical Decision Support 170.315(a)(9)/ Clinical Information Reconciliation and Incorporation 170.315(b)(2)

- 9.1 Import laboratory test (Checklist ID a.9.1)
- 9.2 Enter vital signs and observe clinical decision prompt (Checklist ID a.9.1)
- 9.3 Receive transition of care/referral summary (Checklist ID a.9.1, b.2)
 - Reconcile medications/allergies/problems
- 9.4 Configure Clinical Decision Support (Checklist ID a.9.1)

- 9.5 Verify negative access to change clinical decision support for non-administrator (Checklist ID a.9.1)
- Verify negative clinical decision support for specified use (Checklist ID a.9.1)
- 9.6 Click Infobutton (Checklist ID a.9.1)

Task 10: Implantable Device 170.315(a)(14)

- View implantable device list (Checklist ID a.14)
- Record the specified UDI (Checklist ID a.14)
- Change the status of the implantable device (Checklist ID a.14)

Procedures

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID.

The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. The administrator also took notes on task success, path deviations, number and type of errors, and comments. Participants were instructed to perform the tasks:

- as quickly as possible making as few errors and deviations as possible.
- without assistance; administrators could give immaterial guidance and clarification on tasks, but not instructions on use.
- Without using a think aloud technique.

For each task, the participants were given oral directions. Task timing began once the administrator finished reading the question. The task time was stopped once the participant indicated he or she had successfully completed the task. Scoring is discussed below in section 3.9.

Following the session, the administrator gave the participant the post-test questionnaire (see Appendix 5). Participants were thanked for their time.

Participants' demographic information, task success rate, time on task, errors, deviations, verbal responses, and post-test questionnaire were recorded into a spreadsheet.

Test Location

Usability tests were conducted remotely over a conference call. The administrator started the conference call from an office. Each participant joined the conference call from his/her location. The test administrator could see the participant's screen.

Test Environment

Crystal Practice Management would typically be used in an optometry office setting. This usability testing was conducted remotely, with participants interacting with the Crystal Practice Management software over Citrix GoToMeeting online conferencing software. Using remote testing allowed the participants to use the EHRUT from their normal office location. Participants were given instructions on how to access the meeting online. Once in the meeting, they were given keyboard and mouse control of the test system by the administrator. Because the EHRUT is a client-server (cloud-based) application, each participant was accessing the database utilized for testing using Remote Desktop Protocol (RDP) to the servers hosted at Crystal Practice Management.

Crystal Practice Management staff set up the application per the product documentation describing the system setup and configuration. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation.

Crystal Practice Management staff set up the database used for testing (including user preferences and other configuration options). A reset of the database was used to ensure that the database was in the exact same configuration at the beginning of each participant's test. Participants did not change any of the default system settings. The usability test setup provided a uniform experience to all participants.

Test Forms and Tools

During the usability test, various documents and instruments were used, including:

1. Informed consent
2. Moderator's guide
3. Citrix GoToMeeting software
4. Post-test Questionnaire

Examples of these documents can be found in the Appendices. The Moderator's Guide was devised to be able to capture required data.

The test administrator logged into the GoToMeeting session to observe the test session. The screen of each participant interacting with the EHRUT was recorded using the GoToMeeting recording tool. This recording provided an opportunity to replay the test for later evaluation to ensure the accuracy of timings, performance against the optimal path, etc.

Participant Instructions

The administrator read scenarios and task directions from the Moderator's Guide to each participant.

Following the procedural instructions, participants were then given 10 tasks to complete, one at a time.

Tasks in the Usability Protocol are listed in Appendix 5.

Usability Metrics

According to the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, EHRs should support a process that provides a high level of usability for all users. The goal is for users to interact with the system effectively, efficiently, and with an acceptable level of satisfaction. To this end, metrics for effectiveness, efficiency and user satisfaction were captured during the usability testing. The goals of the test were to assess:

1. Effectiveness of Crystal Practice Management by measuring participant success rates and errors
2. Efficiency of Crystal Practice Management by measuring the average task time and path deviations
3. Satisfaction with Crystal Practice Management by measuring ease-of-use ratings

Data Scoring

Rationale and Scoring

Effectiveness: Task success was determined by assigning numeric weights for various levels of task success, as follows:

Task Success

Success (without assistance) = 1.0
 Partial success = 0.5
 Failure = 0.0

A task was counted as a “Success” if the participant was able to achieve the correct outcome within the time allotted on a per task basis and a ‘Partial success’ if the participant was able to achieve the correct outcome with minimal assistance. A success score for each task was calculated by averaging the scores for each task. The results are provided as a percentage.

Task times were recorded for successes. Observed task times divided by the optimal time for each task were calculated as a measure of optimal efficiency.

Optimal task performance time, as benchmarked by expert performance under realistic conditions, was recorded when constructing tasks. Target task times were operationally derived by multiplying a benchmarked expert performance by a factor of 3, allowing for some time buffer because participants were presumably not trained to expert performance, (2)

some features were new, and (3) some tasks had multiple valid paths to a successful outcome. Thus, if expert, optimal performance on a task was 10 seconds then allotted task

time performance was $[10 * 3.0]$ seconds. This ratio was aggregated across tasks and reported with mean and variance scores.

Effectiveness: Task Failures

If the participant abandoned the task, did not reach the correct answer, performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as a Failure. No task times for failed tasks or tasks that exceeded the target task time were used in calculations.

Correct = 1

Minor Deviations = 0.5

Major Deviations and incomplete = 0

The total number of errors was calculated by grading each task based on “Correct” = 1, “Minor Deviations” = 0.5, and “Major Deviations” = 0, averaging the number of “Correct” and “Minor Deviations” for each task. Next, the formula of $(100 - (\text{Mean “Correct” and “Minor Deviations”}))$ was used to calculate the mean error. Not all deviations were counted as errors. Task failures were also expressed as the mean number of failed tasks per participant.

A qualitative account of the observed errors and error types was collected.

Efficiency: Task Deviations

The participant's navigation path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.

Efficiency: Task Time

Each task was timed from when the administrator said "Begin" until the participant said "Done." If the participant failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task for use in the results analysis. Variance measures (standard deviation and standard error) were also calculated.

Satisfaction: Task Rating

Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question and a post-session questionnaire. After each scenario, the participant was asked to rate "Overall, these tasks were:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data were averaged across participants.

To measure participants' confidence in and likeability of Crystal Practice Management overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly." See full System Usability Score questionnaire in Appendix 6.

Results

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses.

The usability testing results for Crystal Practice Management are detailed below. The results should be seen in light of the objectives and goals outlined in Study Design section. The data yielded actionable results that, when corrected, will yield a material, positive impact on user performance. This was done in order to identify risk prone errors, with a potential likelihood of occurrence and adverse consequences. The results are prioritized in order of greatest to least likelihood of occurrence based on risk associated with user error.

Priority 1 (Highest risk associated with user error) Criteria 170.315(a)(5) Demographics

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
record, change, access patient demographic data, Demographic standards demonstrated, Record declination for demographic data	10	.72 (.26)	1.41	382.5	1.27	.38 (.22)	4.44 (0.73)

Discussion of Findings

Participants were given a demographics tasks:

record, change, access patient demographic data, Demographic standards demonstrated, Record declination for demographic data.

Effectiveness

The success score for the Access and Record Demographics task was 72%, due to 5 participants requiring hints on how to complete the task. 9 participants were ultimately able to review the patient's demographics

and complete the tasks. Once participants discovered where and how to change the new demographics fields, they were easily able to finish the task, indicating more training is needed.

Efficiency

1 participant exceeded the target time for the task, due to unfamiliarity with dual race and dual ethnicity options. Several participants were confused about gender identity and sexual preference fields being required.

Satisfaction

Participants had an average satisfaction rating of 4.44 out of 5 points on a Likert scale. Most participants were able to easily complete the task.

Major Findings

Several participants seemed confused by the Gender Identity selection, because gender selection is still required in a separate location in the software. Participants indicated that a better on-screen assistance would have been helpful.

Areas for Improvement

Include gender questions all on the same screen instead of in two separate locations.

Priority 2

Criteria 170.315(a)(6) Problem List

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
Access and change active problem list.	10	.85 (.24)	2.61	122.5 (49.11)	0.36	.22 (.36)	3.8 (1.48)

Discussion of Findings

Participants were given a problem list task:

Access and change active problem list.

Effectiveness

All participants were able to successfully access and change the problem list, but needed hints as to where the problem list was located as there is no label in the software. Because most participants required hints, the success score was 72%.

Efficiency

All participants completed the tasks with more steps than expert users. Participants completed the tasks within the optimal time for the task, as suggested by expert timings.

Satisfaction

Participants had an average satisfaction rating of 3.8 out of 5 points on a Likert scale. Most participants had no problem completing the task once they located the unlabeled problem list.

Major Findings

Participants were able to access, change, and record problems with no difficulty once they located the problem list, which is not labeled in the software.

Areas for Improvement

Labeling the problem list will greatly improve the ability to locate the problem list.

Priority 3

Criteria 170.315(a)(9) Clinical Decision Support

Data Analysis and Reporting

Task Scores	N	Task Successes	Path Deviation	Task Time		Errors	Task Rating 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
Import lab test, enter vital signs, import a transition of care document, perform medication/allergy/problem reconciliation, demonstrate CDS configuration, demonstrate negative test for unauthorize user, click infoButton	10	.65 (.24)	1.91	389.8 (58.31)	0.77	.20 (.34)	3.1 (1.1)

Discussion of Findings

Participants were given a clinical decision support task:

Import lab test, enter vital signs, import a transition of care document, perform medication/allergy/problem reconciliation, demonstrate CDS configuration, demonstrate negative test for unauthorize user, click infoButton.

Effectiveness

All participants were able to successfully perform and process this task, yielding a task success score at 65% as some participants were only able to complete the task after being given a hint on how to complete this particular task.

Efficiency

All participants were able to complete and enable CDS Interventions task within the optimal time, as suggested by expert timings. Of the ten participants, all completed the task with more steps than the experts.

Satisfaction

Participants had an average satisfaction rating of 3.1 out of 5 points on a Likert scale. Although most participants were unfamiliar with these tasks, they thought the workflows were easy to complete after having done so successfully.

Major Findings

Training will increase familiarity for performing Clinical Decision Support.

Areas for Improvement

Having a designated Clinical Decision Support location in the software would reduce the number of different screens needed to complete the task.

Priority 4 Criteria 170.315(b)(2) Clinical Information Reconciliation and Incorporation

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
Allow user to import, reconcile, and incorporate clinical information	10	.65 (.24)	1.91	389.8 (58.31)	0.77	.20 (.34)	3.1 (1.1)

Discussion of Findings

Participants were given a clinical information reconciliation and incorporation task:
Allow user to import, reconcile, and incorporate clinical information

Effectiveness

All participants were able to successfully perform and process this task, yielding a task success score at 65% as some participants were only able to complete the task after being given a hint on how to complete this particular task.

All participants were ultimately able to review the patient's clinical information, reconcile the data, and complete the tasks.

Efficiency

As the CCD features were unfamiliar to many Crystal Practice Management users, no participants exceeded the target time but all participants exceeded the optimal number of steps for these tasks. However, all participants were ultimately able to complete these tasks, with some participants requiring a hint on how to navigate to the feature.

Satisfaction

Participants had an average satisfaction rating of 3.1 out of 5 points on a Likert scale. Although unfamiliar with these tasks, most participants found them easy to complete.

Major Findings

Users had no problems after they found where to go. Training will improve performance.

Areas for Improvement

Training and a possible concise Clinical Decision Support section in the software will improve usability.

Priority 5 Criteria 170.315(a)(4) Drug-Drug, Drug-Allergy Interactions Checks

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
provide user with drug-drug, drug-allergy contraindication interventions and allow user to change severity level of intervention only using admin privileges	10	.70 (.25)	1.49	306.5 (62.26)	0.76	.30 (.35)	3.9 (0.88)

Discussion of Findings

Participants were given a drug-drug, drug-allergy interactions check task:

Provide user with drug-drug, drug-allergy contraindication interventions and allow user to change severity level of intervention only using admin privileges.

Effectiveness

All participants were able to successfully perform and process this task, yielding a task success score at 70% as some participants were only able to complete the task after being given a hint on how to complete this particular task.

Efficiency

No participants exceeded the target time for completing the task.

Satisfaction

Participants had an average satisfaction rating of 3.9 out of 5 points on a Likert scale. Most participants stated that although they were unfamiliar with the tasks, they were still easy to complete.

Major Findings

The drug-drug and drug-allergy interventions were easy for most participants.

Participants were not familiar with the configuration of drug interactions, as that task is typically a function of the third-party software used, namely, Allscripts.

Areas for Improvement

Several participants seemed confused by the pop-up error message.

The low familiarity rating for the configuration of severity levels task seems to indicate that more training on this feature for clinical staff would increase their awareness of the available functionality and improve its adoption.

Priority 6

Criteria 170.315(a)(14) Implantable Device List

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
record Unique Device Identifiers associated with a patient's Implantable Device, and change the status of an implantable device	10	.66 (.25)	2.3	154.55 (28.23)	1.12	.16 (.25)	3.66 (1)

Discussion of Findings

Participants were given an implantable device list task:

Record Unique Device Identifiers associated with a patient's Implantable Device, and change the status of an implantable device.

Effectiveness

9 participants were able to successfully perform and process this task, yielding a task success score at 66% as some participants were only able to complete the task after being given a hint on how to complete this particular task.

Efficiency

Although the implantable device feature was a relatively new feature for Crystal Practice Management, 9 participants were able to complete the tasks within the optimal time for each task, as suggested by expert timings. All participants exceeded the optimal number of steps for the tasks due to unfamiliarity with this new feature.

Satisfaction

Participants had an average satisfaction rating of 3.66 out of 5 points on a Likert scale. Although unfamiliar with these relatively new tasks, most participants found them easy to complete. The status field did not have a drop down like the problem list did, this confused most participants. Uniformity of similar fields will help users.

Major Findings

Part of the success with using this new feature may be attributable to the training provided to participants.

Areas for Improvement

The status field did not have a drop down like the problem list did, this confused most participants. Uniformity of similar fields will help users.

Priority 7

Criteria 170.315(a)(1) CPOE – Medications

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
record, change, and access medication orders.	10	.75 (.26)	1.2	260.25 (34.56)	1.52	.22 (.36)	4.125 (0.99)

Discussion of Findings

Participants were given the following CPOE—Medications task:

Record and Change Medication Orders

Effectiveness

The success score for each of these tasks was 75%. Participants were moderately able to access and change medication orders as well as record new ones. Hints were required, decreasing the score. Training will improve this score.

Efficiency

All participants completed the task with more steps than the expert users. 9 participants completed the task within the optimal time for each task, as suggested by expert timings.

Satisfaction

Participants had an average satisfaction rating of 4.125 out of 5 points on a Likert scale. Most participants were not familiar with these tasks but found them somewhat easy to complete.

Major Findings

Generally, participants were able to navigate the medication order tasks with moderate ease. Cancelling an order to modify it and resubmit seemed the most confusing.

Areas for Improvement

When changing an order, provide clear guidance on cancelling the existing order so that a change can be made and resubmitted. Further training will increase familiarity.

Priority 8 Criteria 170.315(b)(3) Electronic Prescribing

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
record, change, and access medication orders.	10	.75 (.26)	1.2	260.25 (34.56)	1.52	.22 (.36)	4.125 (0.99)

Discussion of Findings

Physician/provider participants were given an electronic prescribing task:
Allow user to Create, change, cancel, refill, receive status notifications, request and receive medication history using electronic prescribing.

Effectiveness

8 participants were able to successfully perform and process this task, yielding a task success score at 75% as some participants were only able to complete the task after being given a hint on how to complete this particular task. 8 participants were ultimately able to complete the electronic prescription tasks.

Efficiency

Testing electronic prescribing features were relatively new and unfamiliar to most Crystal Practice Management users. One out of ten participants exceeded the optimal time. One out of ten participants did not complete the task due to major deviations. All participants completed these tasks with more steps than the expert users, with the highest number of additional steps attributed to the relatively new electronic prescribing features. All participants were ultimately able to complete these tasks with some requiring a few hints.

Satisfaction

Participants had an average satisfaction rating of 4.125 out of 5 points on a Likert scale. Although unfamiliar with these tasks, most participants were able to complete them successfully.

Major Findings

When using Allscripts, the buttons appear in the middle of the page instead of at the top or the bottom. Many users had difficulty locating the buttons.

Areas for Improvement

Training for users who frequently use E-prescribe has proven the most successful approach.

Priority 9

Criteria 170.315(a)(2) CPOE – Laboratory

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
Electronically record and change a patient's laboratory order.	10	.64 (.24)	1.15	162.14 (25.45)	1.31	.21 (.27)	3.86 (0.89)

Discussion of Findings

Participants were given a CPOE—Laboratory task:
Electronically record and change a patient's laboratory order.

Effectiveness

The success scores for each of these tasks were 64%. Participants were not easily able to access lab orders and record a new lab order without hints.

Efficiency

All participants completed the tasks with more steps than expert users. 7 participants completed the tasks within the optimal time for each task, as suggested by expert timings.

Satisfaction

Participants had an average satisfaction rating of 3.86 out of 5 points on a Likert scale. Few participants were familiar with these tasks and found them confusing to complete.

Major Findings

Participants were not easily able to record a new laboratory order. This task was difficult to complete as the lab order was not clearly marked.

Participants had difficulty locating the lab order screen. Training and labels will increase the ease of use.

Areas for Improvement

Adding a clearly delineated lab order button would improve usability.

Priority 10 Criteria 170.315(a)(8) Medication Allergy List

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
Access and change active medication allergy list	10	.70 (.25)	1.86	119.9	1.22	.20 (.34)	4.2 (0.92)

Discussion of Findings

Participants were given a medication allergy list task:
Access and change active medication allergy list.

Effectiveness

All participants were able to successfully perform and process this task, yielding a task success score at 70% as some participants were only able to complete the task after being given a hint on how to complete this particular task.

Efficiency

All participants exceeded the optimal number of steps for the medication allergy tasks, but all participants completed the tasks within the optimal time for each task, as suggested by expert timings.

Satisfaction

Participants had an average satisfaction rating of 4.2 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found the workflows easy to complete.

Major Findings

This task is similar to the medication list, so participants felt familiar with the allergy list.

Areas for Improvement

Simplification of the allergy add, possibly making the fields identical and in the same position on the screen as the medication fields would improve usability.

Priority 11

Criteria 170.315(a)(3) CPOE – Diagnostic Imaging

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
Electronically record and change a patient's radiology order.	10	.83 (.25)	1.64	97.77 (17.39)	1.22	.16 (.25)	4 (1.12)

Discussion of Findings

Participants were given a CPOE—Diagnostic Imaging task:

Electronically record and change a patient diagnostic imaging order.

Effectiveness

The success score for each of these tasks was 83%. Participants were not easily able to access diagnostic imaging orders and record a new diagnostic imaging order without hints.

Efficiency

All participants completed the tasks with more steps than expert users. 9 participants completed the tasks within the optimal time for each task, as suggested by expert timings.

Satisfaction

Participants had an average satisfaction rating of 4 out of 5 points on a Likert scale. Most participants were not familiar with these tasks and found them somewhat easy to complete.

Major Findings

Participants were moderately able to access diagnostic imaging orders and record a new diagnostic imaging order. These tasks were similar to the laboratory orders and not well marked.

Areas for Improvement

Clear labeling for creating radiology orders would enhance usability. Training will increase familiarity.

Priority 12 (Lowest risk associated with user error) Criteria 170.315(a)(7) Medication List

Data Analysis and Reporting

Task Scores	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=easy
Task	#	Mean (SD)	Deviations (observed/Optimal)	Mean (SD)	Deviations (observed/optimal)	Mean (SD)	Mean (SD)
Access and change active medication list	10	.87 (.23)	1.88	119.63	1.26	.12 (.23)	4.375 (0.92)

Discussion of Findings

Participants were given a medication list task:

Access and change
medication list.

Effectiveness

All participants were able to successfully perform and process this task, yielding a task success score at 70% as some participants were only able to complete the task after being given a hint on how to complete this particular task. Participants were easily able to access the medication list once they located it in the software. Unfamiliarity can be eliminated with more training.

Efficiency

8 participants completed the task with more steps than expert users.

Satisfaction

Participants had an average satisfaction rating of 4.375 out of 5 points on a Likert scale.

Major Findings

Participants found the medication list easily but were confused by the search function and drop downs for selecting new medications.

Areas for Improvement

Training and labeling will improve the usability of the medication add.

Discussion of the Findings

In addition to the specific findings and areas for improvement in specific features, several overall areas for improvement recurred throughout this usability study.

Low familiarity ratings with certain functionality, along with participants' lack of awareness of the existence of some functionality, may indicate a need for training and documentation that is accessible within common workflows and provided in formats that are easily consumable by busy clinical professionals.

Another recurring feedback from participants was that CCD warnings were too numerous and would be too cumbersome to take time to read and maintain a busy schedule in the office setting. This feedback identifies opportunities to make refinements to the user interface to reduce click-counts and enhance efficiency for clinicians.

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 71.75. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

Through the user-centered design and usability testing processes, opportunities to refine and enhance the user experience were identified. Some of these enhancements have been prioritized for release in upcoming release cycles. Still others will be revisited in more depth in future studies.

Appendices

Appendix 1: Sample Recruiting screener

Recruiting Questionnaire

Please PRINT, Fill out, and FAX the completed form to Crystal Practice Management at 888-503-1831

1. Name: _____
2. Gender
 - Male
 - Female
 - Other
3. Age
 - 0-9
 - 10-19
 - 20-29
 - 30-39
 - 40-49
 - 50-59
 - 60-69
 - 70-79
 - 80-89
 - 90-99
 - 100+
4. Level of Education
 - No High School Degree
 - High School Graduate, diploma or equivalent (ex: GED)
 - Trade/technical/vocational training
 - Some college credit, no degree
 - Associate degree
 - Bachelor's degree
 - Master's degree
 - Doctorate degree (e.g., MD, PhD)
5. How long have you been working in healthcare? Please specify whether your answer is in years, months, or days
(example: 10 years): _____
6. What is your optometric specialty? _____
7. How long have you been using computers? Please specify whether your answer is in years, months, or days (example: 10 years). _____

8. How long have you been using Crystal Practice Management? Please specify whether your answer is in years, months, or days (example: 10 years). _____

9. Which features do you use most frequently? Please list your top 2 or 3 (for instance, orders, prescriptions, labs, notes, flow sheets, tasks, etc.).

- 1.
- 2.
- 3.

10. On a scale of 1 to 5 with 5 being 'Most Familiar', how would you rate your level of familiarity with these workflows in Crystal Practice Management: (Circle a number for each statement)

- | | | | | | | | |
|--|----------------|---|---|---|---|---|---------------|
| a. Maintaining Medication Allergies | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| b. Maintaining Problem Lists | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| c. Reviewing and Satisfying Clinical Alerts | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| d. Setting Up Clinical Alerts | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| e. Maintaining Medication Lists | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| f. Creating Orders (using the orders system) | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| g. Ordering Lab Tests | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| h. Reviewing Drug Interactions | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| i. Configuring the Drug Interactions | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| j. Reviewing and Retrieving CCDAs | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| k. Entering Demographic Data | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| l. Maintaining Implantable Device Lists | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| m. Checking the Fill Status of an e-Rx from the Pharmacy | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| n. Processing an e-Rx Change Request from the Pharmacy | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |
| o. Sending a Cancel Notice to the Pharmacy on e-Rx Discontinue | Least Familiar | 1 | 2 | 3 | 4 | 5 | Most Familiar |

11. Do you require any assistive technology to participate in this usability test? (Assistive technology (AT) is any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities.)

- Yes
- No

Appendix 2: Participant Demographics

	Participant Summary							
Participant Identifier	Participant Gender	Participant Age	Participant Education	Participant Occupation/Role	Participant Professional Experience	Participant Computer Experience	Participant Product Experience	Participant Assistive Technology Needs
ID01	Female	40-49	Some college credit, no degree	Insurance/Billing	180	300	192	No
ID02	Female	50-59	Some college credit, no degree	Insurance Billing and coding	348	348	168	No
ID03	Female	60-69	Associate degree	Contact Lens Optician	480	360	156	No
ID04	Female	40-49	Some college credit, no degree	Optometric Assistant	54	300	9	No
ID05	Female	50-59	High school graduate, diploma or the equivalent (for example: GED)	Optometric Assistant	156	348	12	No
ID06	Female	30-39	Bachelor's Degree	Optician	180	240	36	No
ID07	Male	20-29	Some college credit, no degree	Optician	48	228	4	No
ID08	Female	50-59	No high school degree	Optometric Assistant	384	300	168	No
ID09	Female	20-29	Some college credit, no degree	Insurance/Billing	72	264	48	No
ID10	Female	20-29	High school graduate, diploma or the equivalent (for example: GED)	Insurance/Billing	42	228	42	No

Appendix 3: Informed Consent

Consent & Recording Release Form

I agree to participate in the study conducted and recorded by Crystal Practice Management.

I understand and consent to the use and release of the recording by Crystal Practice Management. I understand that the information and recording is for research purposes only and that my name and image will not be used for any other purpose. I relinquish any rights to the recording and understand the recording may be copied and used by Crystal Practice Management without further permission.

I understand that participation in this usability study is voluntary and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

Please sign below to indicate that you have read and you understand the information on this form and that any questions you might have about the session have been answered.

Date: _____

Please print your name: _____

Please sign your name: _____

Thank you!

We appreciate your participation.

Appendix 4: Example Moderator's Guide

Moderator's Guide

Administrator: _____

Date _____ Time _____

Participant # _____

Prior to testing:

- Confirm schedule with participant
- Ensure EHRUT environment is running properly
- Ensure remote session and recording equipment are running properly

Prior to each participant:

- Reset application
- Start session recording with GoToMeeting.

After each participant:

- End session recording with GoToMeeting.

After all testing:

- Back up all video and data files

ORIENTATION

Thank you for participating in this usability study. CrystalPM is being evaluated today, not you. You will be given patient scenarios and asked to perform certain tasks in the software. I will record this session to help me with my report.

I am going to start recording the session now.

There are several patients loaded in CrystalPM with mock information. I will ask you to perform tasks using specific patients. For each patient, I will give you information to enter, submit, or import from external sources.

Let's Begin:

Appendix 5: User Tasks

TASK 1: Demographics 170.315(a)(5)/Clinical Decision Support 170.315(a)(9)

1. A patient named Philip Doe comes into the office, please record his Demographics:

Race Granular: **African**

Verify the aggregate Race is **Black or African American**.

Ethnicity Granular: **Bolivian**

Verify the aggregate Ethnicity is **Hispanic or Latino**.

[Verify a Clinical Decision Support prompt occurred for Hispanic or Latino]

Preferred Language: **English**

Sex: **Male**

Sexual Orientation: **Straight or heterosexual**

Gender Identity: **Identifies as Male**

2. Philip Doe decides to give more detailed answers to the Demographics question:

Change Granular Race to **Abenaki and African**

Verify the Race (non-Granular) is auto-filled with **American Indian or Alaska Native and Black or African American**

Change Granular Ethnicity to **Bolivian and Canal Zone**

Verify the Ethnicity (non-Granular) is auto-filled with **Hispanic or Latino**

Preferred Language: **Spanish**

Sex: **Female**

Sexual Orientation: **Lesbian, gay or homosexual**

Gender Identity: **Female-to-Male (FTM)/Transgender Male/Trans Man.**

Date of Birth: **11/19/1975**

3. Philip decides to update his answers again. Please update the following:

Race: **Patient Declined to Specify**

Ethnicity: **Patient Declined to Specify**

Language: **Patient Declined to Specify**

Sexual Orientation: **Choose not to disclose**

Gender Identity: **Decline to answer**

[Software Description: While performing the user tasks under TASK 1, the user entered the patient demographics on an existing patient in Crystal, changed the demographics, a Clinical Decision Support for Hispanic or Latino window popped up automatically, finally, the user changed the demographics to “Declined”. When the task was complete, the changed demographics were automatically displayed by the software.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

There are no more demographic changes today.

Medications**TASK 2: CPOE Medications 170.315(a)(1)/E-Prescribe 170.315(b)(3)**

1. Jane Doe comes into your office complaining about her eye. You decide to prescribe her
(Checklist ID: a.1, b.3.1)

RX: **Patanol .1% Ophthalmic GTTS**

Sig: **1gtt OU QID for 5 days**

Refill: **None**

2. Before Jane leaves the office, you decide to go back into the Medication Order and change the quantity of refills
(Checklist ID: a.1, b.3.1)

Refill: **2x within 1 year**

[Software Description: This task utilized an integrated third party software called ALLSCRIPTS. When creating a prescription in ALLSCRIPTS, the prescription is displayed. In order to change a prescription in ALLSCRIPTS, the original prescription must be cancelled. When the changes are made to the refill and the changed medication order is saved, the prescription is displayed by checking the status, which displays the fill status notification.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

TASK 3: Drug-drug, Drug-allergy Interaction Checks 170.315(a)(4)/E-Prescribe 170.315(b)(3)

1. Login to E-Prescribe for Jacob Doe and try to add the medication (Checklist ID: a.4, b.3.2)

[Software Description: Allscripts automatically requests and receives the medication history, both active and discontinued. Allscripts automatically displays a drug-allergy warning when the user performs this task.]

Warfarin 10MG Tablet, Take 1 Tablet a day.
Report the warning to the test administrator

2. Login to E-prescribe for Jacob Doe and try to add the medication (Checklist ID: a.4, b.3.2)

[Software Description: Allscripts automatically requests and receives the medication history, both active and discontinued. Allscripts automatically displays a drug-drug warning when the user performs this task.]

Vicks DayQuil/NyQuil Cold & Flu;
Report the warning to the test administrator

3. Adjust severity level of drug-drug interaction check (Checklist ID: a.4)

Login to Crystal PM as Dr. Doctor, William (password: will)
Change the DUR Settings of "Minimum Severity Level" to: Minor

4. Login into Crystal PM as (Checklist ID a.4)

Dr. Doctor, Joe (password: joe)
Verify the Settings Menu is not visible.
Log back into CrystalPM as Dr. Doctor, William (password: will)

[Software Description: Allscripts automatically requests and receives the medication history, both active and discontinued. Allscripts automatically displays The DUR settings are adjusted inside Allscripts. Allscripts is user specific, only users with admin privileges may access the DUR settings.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

TASK 4: [Medication List 170.315\(a\)\(7\)](#)/ [Clinical Decision Support 170.315\(a\)\(9\)](#)

1. Patient Joseph Doe comes into the office. **[Software Description: The “current” Medication List displays both active and discontinued medications]** (Checklist ID: a.7)
[Review his current Medication List.](#)

2. Joseph Doe currently takes **Amiodarone [RXNorm 703]**. (Checklist ID: a.7, a.9.3)
[Add it to his current Medication List. Verify that adding Amiodarone results in a Clinical Decision Support Prompt.](#)

[Software Description: The “current”, or present Medication List displays both active and discontinued medications. When the user adds Amiodarone, a Clinical Decision Support Prompt appears and will not allow the user to continue using the software until clicking a button acknowledging the CDS prompt.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

TASK 5: Medication Allergy List 170.315(a)(8)/ Clinical Decision Support 170.315(a)(9)

3. Patient Dottie Doe comes into the office. (Checklist ID: a.8)
Please review her current Allergies.

4. Dottie is now allergic to **Lisinopril [RxNorm: 29046]** (Checklist ID: a.8, a.9.4)
its reaction is a Fever, and considered a Severe reaction. Verify that adding **Lisinopril** results in a Clinical Decision Support Prompt.

[Software Description: The “current”, or present Allergy List displays both active and resolved allergies. When the user adds Lisinopril, a Clinical Decision Support Prompt appears and will not allow the user to continue using the software until clicking a button acknowledging the CDS prompt.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

CPOE (Computerized Physician Order Entry)

TASK 6: CPOE Laboratory 170.315(a)(2)

1. Jill Doe comes into the office worried about Diabetes Retinopathy. You decide to order her a glucose lab order. (Checklist ID a.2)

Lab Name: **Glucose in Blood**

Filler Order #: **1001**

Type: **Laboratory**

Date: **Current Date and Time**

Status: **Pending/in process, scheduled**

Universal Service Identifier: **40858-3 - Glucose^baseline:MCnc:Pt:BldC:Qn**

2. Change the status of this order to (Checklist ID a.2)

Status: **Complete**

[Software Description: During the course of answering this question the software displays the changed lab order after the user adds, saves, then changes the order.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

TASK 7: CPOE Radiology 170.315(a)(3)

1. Jill Doe comes into the office worried about Diabetes Retinopathy. You decide to order her an Orbit CT Scan. (Checklist ID a.3)

Lab Name: **OCT**

Filler Order #: **1002**

Type: **Radiology/Imaging**

Date: **Current Date and Time**

Status: **Pending/in process, scheduled**

Universal Service Identifier: **41807-9 Orbit CT**

2. Change the date (Checklist ID a.3)

Date: **7/20/2017**

[Software Description: When the user adds, saves, then changes the radiology order, the software displays the changed Imaging order.]

SUCCESS:

- **Easily Completed**
- **Completed with Difficulty or help**
- **Not completed**

Task Time: _____ Seconds

- **Correct**
- **Minor Deviations**
- **Major Deviations**

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

TASK 8: Problem List 170.315(a)(6)/ Clinical Decision Support 170.315(a)(9)

1. Patient Joseph Doe comes into the office (Checklist ID a.6)
review his Current Problem List.
2. Joseph Doe no longer has Headaches (Checklist ID a.6, a.9.5)
change the Status to **Resolved**. He also is currently suffering from **Acquired hypothyroidism** [111566002]. Verify that adding **Acquired hypothyroidism** results in a Clinical Decision Support Prompt.

[Software Description: When reviewing the “current”, or present problem list, the user sees both active and resolved problems. After the user completes changing and adding a problem, the final result displays all changes, including both active and resolved problems.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

Optimal Path: See training guide

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

TASK 9: Clinical Decision Support 170.315(a)(9)/ Clinical Information Reconciliation and Incorporation 170.315(b)(2)

1. Import Laboratory Tests (Checklist ID a.9.1)

Import File from the Desktop LRI_3.0_GU_RU_LipidPanel.txt into the Lab Results File. Verify that a Clinical Decision Support Prompt was displayed.

[Software Description: A CDS prompt automatically displays when importing this lab test.]

2. Vital signs (Checklist ID a.9.1)

Enter the blood pressure as **150/120**. Verify that a Clinical Decision Support Prompt was displayed.

[Software Description: A CDS prompt automatically after entry of this blood pressure.]

3. Receive Transition of Care/referral summary (Checklist ID a.9.1, b.2)

Go to **Import / Export** and **Import/View Health Record CCR / CCD / CCDA**. Select the File on the Desktop **170.315_b1_toc_inp_ds_r21_sample1_v3.xml**

Perform a **Medication/Allergy/Problem Reconciliation**. Verify that the process allows you to compare existing data and that from the imported file. Verify that it allows you to select which information will be consolidated. Verify that it stores the Consolidated Data into the Patients Chart.

Verify that a **Clinical Decision Support Prompt** is displayed for **Medication, Allergy, and Problem**.

[Software Description: When the user imports the CCDA, the user sees a side by side comparison of existing medications, Allergies, and Problems. The user can select which information to consolidate. Once the consolidation selections are made and the user clicks on the close button, the software triggers multiple CDS prompts for medication, allergy, problem list, resources, and populates a new CCDA with the reconciled data.]

4. CDS Configuration (Checklist ID a.9.1)

Enable interventions and reference resources specified in paragraphs (a)(9)(iii) and (iv) of this section to be configured by a limited set of identified users (e.g., system administrator) based on a user's role.

Enable interventions:

- (A) Based on the following data:

Within the Medical Records Go to the Menu Item **EHR Settings → Page Options → Clinical Decision Support**

Click Active on the following CDS Items

- (i) Problem list;

[Enable Hypertension](#)

- (ii) Medication list

[Enable Medication Metoprol Tartrate](#)

- (iii) Medication allergy list;

[Enable Allergy to Aspirin](#)

- (iv) At least one demographic specified in paragraph (a)(5)(i) of this section;

[Enable Demographics race Alaska Native](#)

- (v) Laboratory tests; and

[Enable lab prompt](#)

- (vi) Vital signs

[Enable systolic bp ,also change the systolic bp to be for Doctors Only, also take note of the developer, citation, release/version information](#)

[Software Description: The software displays bibliographic citation, developer, and release/version information]

5. Login with user Joe Doctor, PW joe . verify the **EHR Settings → Page Options → Clinical Decision Support is not available** (Checklist ID a.9.1)
[Software Description: The software does not allow a user without permission to access CDS.]
Verify that no Clinical Decision Support Items are prompted when logged in with user Joe Williams (Checklist ID a.9.1) [Software Description: The software does not allow a user without permission to access CDS.]
6. Click the InfoButton on the ARRA page. Verify that relevant information for the patient is displayed (Checklist ID a.9.1) [Software Description: The software displays the InfoButton information on a pop-up window.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

TASK 10: [Implantable Device 170.315\(a\)\(14\)](#)

1. View the Implantable Device Grid on the ARRA tab (Checklist ID a.14)
2. Patient Jane Doe reports that she has an implantable device, record the following UDI: (copy and paste the device ID from the test folder on the desk top) (Checklist ID a.14)
[\(01\)10884521062856\(11\)141231\(17\)150707\(10\)A213B1\(21\)1234](#)
3. The patient reports the device has been removed. (Checklist ID a.14)
[change the status of one of the implantable devices from active to inactive.](#)

[Software Description: While recording and changing the UDI, the software displays the UDI, device description, identifiers, and attributes.]

SUCCESS:

- Easily Completed
- Completed with Difficulty or help
- Not completed

Task Time: _____ Seconds

- Correct
- Minor Deviations
- Major Deviations

Observed errors and verbalizations: _____

Rating: Very Difficult 1 2 3 4 5 Very Easy

THIS IS THE END OF THE USABILITY TEST. Please take the short survey about your experience.

Appendix 6: System Usability Scale Questionnaire

System Usability Scale

Based on your overall experience with all the tasks, please answer the following questions:

1. **I think that I would like to use this system frequently**
Strongly Disagree 1 2 3 4 5 Strongly Agree
2. **I found the system unnecessarily complex**
Strongly Disagree 1 2 3 4 5 Strongly Agree
3. **I thought that the system was easy to use**
Strongly Disagree 1 2 3 4 5 Strongly Agree
4. **I think that I would need the support of a technical person to be able to use this system**
Strongly Disagree 1 2 3 4 5 Strongly Agree
5. **I found the various functions in this system were well integrated**
Strongly Disagree 1 2 3 4 5 Strongly Agree
6. **I thought there was too much inconsistency in this system**
Strongly Disagree 1 2 3 4 5 Strongly Agree
7. **I would imagine that most people would learn to use this system very quickly**
Strongly Disagree 1 2 3 4 5 Strongly Agree
8. **I found the system very cumbersome to use**
Strongly Disagree 1 2 3 4 5 Strongly Agree
9. **I felt very confident using the system**
Strongly Disagree 1 2 3 4 5 Strongly Agree
10. **I needed to learn a lot of things before I could get going with this system**
Strongly Disagree 1 2 3 4 5 Strongly Agree